

The documentation and process conversion measures necessary to comply with this revision shall be completed by 15 July 1998

INCH-POUND

MIL-PRF-19500/589A
15 April 1998
SUPERSEDING
MIL-S-19500/589
24 June 1993

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, INSULATED GATE, BIPOLAR
N-CHANNEL, SILICON TYPES 2N7367 AND 2N7368, JAN, JANTX, JANTXV, AND JANS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for an insulated gate bipolar power transistor. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (TO-258) for 2N7367 and figure 2 (TO-259) for 2N7368.

1.3 Maximum ratings. At $T_C = 25^\circ\text{C}$, unless otherwise specified. 1/ 2/

Type	P_T 3/ $T_C = +25^\circ\text{C}$	P_T $T_C = +25^\circ\text{C}$	V_{GE}	I_{C1} 4/ $T_C = +25^\circ\text{C}$	I_{C2} $T_C = +100^\circ\text{C}$	I_{CM} 5/	$V_{BR(CES)}$ $V_{GE} = 0\text{ V}$ $I_C = 1.0\text{ mA}$	V_F $I_F = I_{C2}$
	<u>W</u>	<u>W</u>	<u>V dc</u>	<u>A dc</u>	<u>A dc</u>	<u>A (pk)</u>	<u>V dc</u>	<u>V</u>
2N7367	200	4	± 20	45	27	220	600	1.7

Type	I_{LM} 6/	$V_{(ISO)}$ at 70 K feet	$R_{\theta JC1}$ max for I_{GBT}	$V_{CE(on)}$ max		T_J and T_{STG}	T_{RR} $I_F = I_{C2}$	$R_{\theta JC2}$ max for diode
				$V_{GE} = 15\text{ V}$	$I_C = I_{C2}$			
				$T_J = +25^\circ\text{C}$	$T_J = +150^\circ\text{C}$			
	<u>A</u>		<u>$^\circ\text{C/W}$</u>	<u>V</u>	<u>V</u>	<u>$^\circ\text{C}$</u>	<u>ns</u>	<u>$^\circ\text{C/W}$</u>
2N7367	220	600	0.64	3.0	2.89	-55 to +150	100	1.2

1/ Pulsed (see 4.5.1).

2/ Electrical and thermal ratings are identical for both 2N7367 and 2N7368.

3/ Derate linearly $1.56\text{ W}/^\circ\text{C}$ for $T_C > +25^\circ\text{C}$; $P_T = \frac{T_{JM} - T_C}{R_{\theta JC}}$.

4/ Package limited to 45 A dc.

5/ $I_{CM} = 4 \times I_C$.

6/ Clamped inductive load current.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

1.4 Primary electrical characteristics at +25°C. 1/

Type	I_{GES} (Max) $V_{GE} = \pm 20$ V $V_{CE} = 0$ V	$V_{GE(th)}$ $V_{CE} \geq V_{GE}$ $I_C = 0.25$ mA	I_{CES} Max $V_{GE} = 0$ V $V_{CE} = 80$ percent max rated V_{CE}	V_{CE} (on) Max $V_{GE} = 15$ V $I_C = I_{C1}$	I_{RM} of diode $I_F = I_{CZ}$
	<u>nA dc</u>	<u>V dc</u> Min Max	<u>μA dc</u>	<u>V</u>	<u>A</u>
2N7367	100	3.0 5.5	250	3.25	10
2N7368	100	3.0 5.5	250	3.25	10

1/ Pulsed (see 4.5.1).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

STANDARD

MILITARY

MIL-STD-750 - Test Methods for Semiconductor Devices.

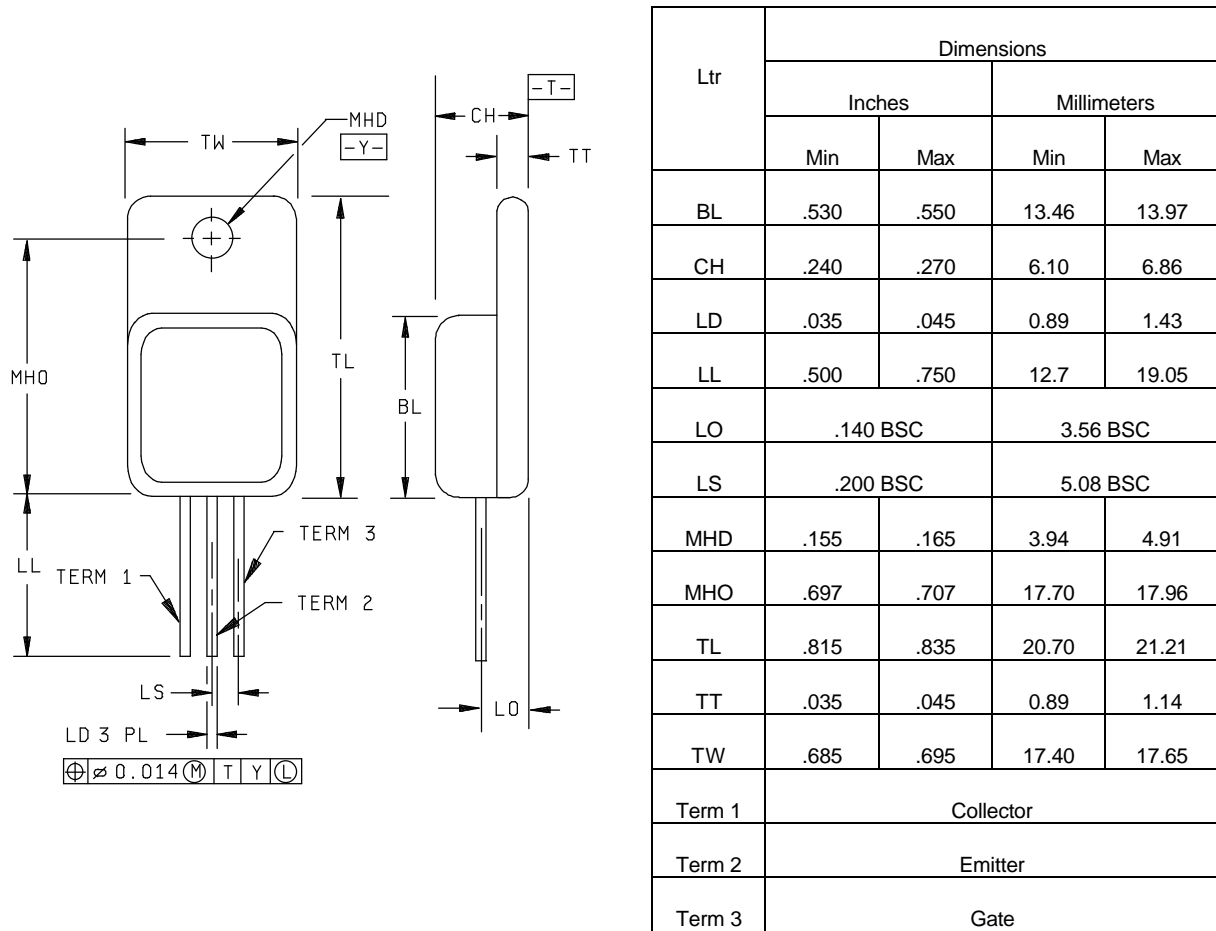
(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

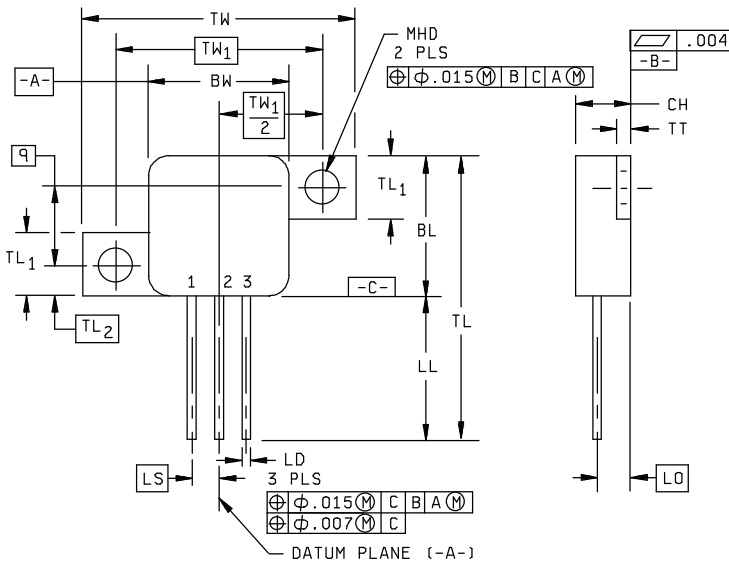
3.2 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500.



NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Metric equivalents are in parentheses.
4. Refer to applicable symbol list.
5. Glass meniscus included in dimensions TL and TW.

FIGURE 1. Dimensions and configuration (TO-258).



NOTES:

1. Refer to applicable symbol list.
2. Dimensions and tolerance in accordance with ANSI Y14.5M - 1982.
3. All dimension in inches.
4. Term 1 = Collector, Term 2 = Emitter, Term 3 = Gate.

Symbol	Dimension			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.530	.550	13.46	13.97
BW	.685	.695	17.40	17.65
CH	.240	.270	6.10	6.86
LD	.055	.065	1.40	1.65
LL	.500	.750	12.70	19.05
LO	.140 BSC		3.56 BSC	
LS	.200 BSC		5.08 BSC	
MHD	.120	.130	3.05	3.30
TL	1.030	1.300	26.16	33.02
TL ₁	.245	.255	6.22	6.48
TL ₂	.125 BSC		3.18 BSC	
TT	.035	.045	0.89	1.14
TW	1.185	1.195	30.10	30.35
TW ₁	.940 BSC		23.88 BSC	
q	.285 BSC		7.24 BSC	

FIGURE 2. Physical dimensions of TO-259.

3.3 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and on figures 1 and 2 herein.

3.3.1 Lead finish. Lead finish shall be solderable as defined in MIL-STD-750, MIL-PRF-19500, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

3.4 Marking. Marking shall be in accordance with MIL-PRF-19500.

3.5 Electrostatic discharge protection. The devices covered by this specification require electrostatic protection.

3.5.1 Handling. MOS devices must be handled with certain precautions to avoid damage due to the accumulation of electrostatic charge. The following handling practices shall be followed:

- a. Devices shall be handled on benches with conductive handling devices.
- b. Ground test equipment, tools, and personnel handling devices.
- c. Do not handle devices by the leads.
- d. Store devices in conductive foam or carriers.
- e. Avoid use of plastic, rubber, or silk in MOS areas.
- f. Maintain relative humidity above 50 percent if practical.
- g. Care shall be exercised, during test and troubleshooting, to apply not more than maximum rated voltage to any lead.
- h. Gate must be terminated to source, $R \leq 100 \text{ k}$, whenever bias voltage is to be applied drain to source.

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in 4.4.2 and 4.4.3 herein.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Screening (see 4.3)
- c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500.

4.2.1 Group E inspection. Group E inspection shall be conducted in accordance with MIL-PRF-19500 and table II herein.

4.3 Screening (JANS, JANTX and JANTXV levels only). Screening shall be in accordance with MIL-PRF-19500 (Appendix E, table IV), and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see appendix E, table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
<u>1</u> /	Gate stress test (see 4.5.3)	Gate stress test (see 4.5.3)
<u>1</u> /	Clamped I_L test (see 4.5.5)	Clamped I_L test (see 4.5.5)
<u>1</u> /	Thermal response (see 4.5.4)	Thermal response (see 4.5.4)
9 <u>1</u> /	Group A, subgroup 2	Group A, subgroup 2
10	MIL-STD-750, method 1042, test condition B	MIL-STD-750, method 1042, test condition B
11	I_{GESF1} , I_{GESR1} , I_{CES1} , $V_{CE(on)}$, $V_{GE(th)}$ $\Delta I_{GES} = \pm 50$ nA or 100 percent of initial value, whichever is greater. $\Delta I_{CES} = \pm 250$ μ A or 100 percent of initial value, whichever is greater. Subgroup 2 of table I herein.	I_{GESF1} , I_{GESR1} , I_{CES1} , $V_{CE(on)}$, $V_{GE(th)}$ Subgroup 2 of table I herein
12 <u>2</u> /	MIL-STD-750, method 1042, test condition A, $T_A = +125^\circ\text{C}$ minimum	MIL-STD-750, method 1042, test condition A, $T_A = +125^\circ\text{C}$ minimum
13	Subgroups 2 and 3 of table I herein. $\Delta I_{GES} = \pm 50$ nA or 100 percent of initial value, whichever is greater. $\Delta I_{CES} = \pm 250$ μ A or 100 percent of initial value, whichever is greater. $\Delta V_{CE(ON)} = \pm 20$ percent of initial value. $\Delta V_{GE(th)} = \pm 20$ percent of initial value.	Subgroup 2 of table I herein. $\Delta I_{GES} = \pm 50$ nA or 100 percent of initial value, whichever is greater. $\Delta I_{CES} = \pm 250$ μ A or 100 percent of initial value, whichever is greater. $\Delta V_{CE(ON)} = \pm 20$ percent of initial value. $\Delta V_{GE(th)} = \pm 20$ percent of initial value.

1/ Shall be performed anytime before screen 10.

2/ No heat sinking of devices is allowed.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with appendix E, table V of MIL-PRF-19500 and table I herein. (Endpoint electrical measurements shall be in accordance with the applicable steps of table III herein.) Electrical and thermal conditions and limits are identical for both 2N7367 and 2N7368.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table IVa (JANS) and table IVb (JANTX and JANTXV) of MIL-PRF-19500. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps of table III herein.

4.4.2.1 Group B inspection, appendix E, table VIa (JANS) of MIL-PRF-19500.

- a. Subgroup 3 Condition for bond strength is condition A.
- b. Subgroup 4 Condition for intermittent operation life is as follows:
Condition D, 2,000 cycles. The heating cycle shall be one minute minimum.
- c. Subgroup 5: Condition for accelerated steady-state reverse bias is as follows:
Condition A, $V_{CE} = 80$ percent of rated, $T_C = +150^\circ\text{C}$, -15°C , $t = 120$ hours. Read and record $V_{BR(CES)}$ (pre and post) at $I_C = 1$ mA. Read and record I_{CES} (pre and post), in accordance with table III.
- d. Subgroup 5: Condition for accelerated steady-state gate stress is as follows:
Condition B, $V_{GE} = 80$ percent of rated, $T_A = +175^\circ\text{C}$, $t = 24$ hours.
- e. Subgroup 6: Condition for thermal resistance, see 4.5.2.

4.4.2.2 Group B inspection, appendix E, table VIb (JANTX and JANTXV) of MIL-PRF-19500.

- a. Subgroup 3: Condition for intermittent operation life is as follows:
Condition D, 2,000 cycles. The heating cycle shall be one minute minimum.
- b. Subgroup 4: Condition for bond strength is condition A.
- c. Subgroup 6: Not applicable.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table VII of MIL-PRF-19500. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps of table III herein.

4.4.3.1 Group C inspection, appendix E, table VII of MIL-PRF-19500.

- a. Subgroup 2: Condition for terminal strength (tension) is test condition A, weight 10 pounds, time = 15 seconds.
- b. Subgroup 6: Condition for intermittent operation life is as follows:

Condition D, 6,000 cycles. The heating cycle shall be one minute minimum.

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with appendix E, table IX of MIL-PRF-19500 and table II herein.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Pulse measurements. Conditions of pulse measurements shall be as specified in section 4 of MIL-STD-750.

4.5.2 Thermal resistance.

4.5.2.1 Thermal resistance for IGBT. Thermal resistance measurements shall be performed in accordance with method 3103 of MIL-STD-750. The maximum limit of $R_{\theta JC(max)}$ shall be 0.64°C/W . The following parameter measurements shall apply:

- a. Measuring current (I_M) 10 mA.
- b. Collector heating current (I_H) 4 A minimum.
- c. Heating time (t_H) Steady-state (see MIL-STD-750, method 3103, for definition).
- d. Collector-emitter heating voltage (V_H) 25 V minimum.
- e. Measurement time delay (t_{MD}) 30 to 60 μs .
- f. Sample window time (t_{SW}) 10 μs maximum.

4.5.2.2 Thermal resistance for diode. Thermal resistance measurements shall be performed in accordance with method 3101 of MIL-STD-750. The maximum limit of $R_{\theta JC(max)}$ shall be 1.2°C/W . The following parameter measurements shall apply:

- a. Measuring current (I_M) 10 mA.
- b. Collector heating current (I_H) 15 A minimum.
- c. Heating time (t_H) Steady-state (see MIL-STD-750, method 3103, for definition).
- d. Measurement time delay (t_{MD}) 30 to 60 μs .
- e. Sample window time (t_{SW}) 10 μs maximum.

4.5.3 Gate stress test.

$V_{GE} = 30 \text{ V}$ minimum.

$t = 250 \mu\text{s}$ minimum.

4.5.4 Thermal response (measurements).

4.5.4.1 Thermal response (measurements) for IGBT. The ΔV_{GE} measurements shall be performed in accordance with method 3103 of MIL-STD-750. The ΔV_{GE} conditions (I_H and V_H) and maximum limit shall be derived by each vendor from the thermal response curves (see figure 3). The ΔV_{GE} measurement and conditions for each device in the qualification lot shall be submitted (read and record) in the qualification report. The chosen ΔV_{GE} shall be considered final after the manufacturer has had the opportunity to test five consecutive lots. The following parameter measurements shall apply:

- a. Measuring current (I_M) 10 mA.
- b. Collector heating current (I_H) 4 A minimum.
- c. Heating time (t_H) 75 ms minimum.
- d. Collector-emitter heating voltage (V_H) 25 V minimum.
- e. Measurement time delay (t_{MD}) 30 to 60 μ s.
- f. Sample window time (t_{SW}) 10 μ s maximum.

4.5.4.2 Thermal response (measurements) for diode. The ΔV_F measurements shall be performed in accordance with method 3101 of MIL-STD-750. The ΔV_{GE} conditions (I_H and V_H) and maximum limit shall be derived by each vendor from the thermal response curves (see figure 3). The ΔV_{GE} measurement and conditions for each device in the qualification lot shall be submitted (read and record) in the qualification report. The chosen ΔV_F shall be considered final after the manufacturer has had the opportunity to test five consecutive lots. The following parameter measurements shall apply:

- a. Measuring current (I_M) 10 mA.
- b. Collector heating current (I_H) 50 A minimum.
- c. Heating time (t_H) 50 ms minimum.
- d. Measurement time delay (t_{MD}) 30 to 60 μ s.
- e. Sample window time (t_{SW}) 10 μ s maximum.

4.5.5 Clamped inductive load. This test shall be performed in accordance with method 3490 of MIL-STD-750.

- a. $V_{CC} = 50$ V minimum.
- b. $V_G = 20$ V.
- c. $L = 10$ μ H minimum.
- d. $R_G = 2$ ohms.
- e. $V_{CL} = 80$ percent $V_{BR(CE)}$ maximum.
- f. $I_L = 220$ A minimum.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical	2071					
<u>Subgroup 2</u>						
Breakdown voltage, collector to emitter	3407	$V_{GE} = 0$; $I_C = 1.0$ mA bias condition C	$V_{BR(CES)}$	600		V
Gate to emitter voltage (threshold)	3403	$V_{CE} \geq V_{GE}$; $I_C = 0.25$ mA	$V_{GE(th)1}$	3.0	5.5	V dc
Gate current	3411	$V_{GE} = 20$ V; $V_{CE} = 0$ V bias condition C	I_{GESF1}		100	nA dc
Gate current	3411	$V_{GE} = -20$ V; $V_{CE} = 0$ V bias condition C	I_{GESR1}		-100	nA dc
Collector current	3413	Bias condition C; $V_{GE} = 0$ V $V_{CE} = 80$ percent of rated V_{CE}	I_{CES1}		250	μ A dc
Static collector to emitter on-state voltage	3405	$V_{GE} = 15$ V; $I_C = I_{C2}$ condition A; pulsed (see 4.5.1)	$V_{CE(on)1}$		3.0	V
Static collector to emitter on-state voltage	3405	$V_{GE} = 15$ V; $I_C = I_{C1}$ condition A; pulsed (see 4.5.1)	$V_{CE(on)2}$		3.25	V
Forward voltage	4011	$V_G = 0$; $I_F = I_{C2}$	V_F		1.7	V
<u>Subgroup 3</u>						
High temperature operation:		$T_C = T_J = +125^\circ\text{C}$				
Gate current	3411	Bias condition C, $V_{GE} = 20$ V; $V_{CE} = 0$ V	I_{GES}		500	nA dc
Gate current	3411	Bias condition C, $V_{GE} = 20$ V; $V_{CE} = 0$ V	I_{GES}		-500	nA dc
Collector current	3413	Bias condition C, $V_{GE} = 0$ $V_{CE} = 100$ percent of rated V_{CE}	I_{CES2}		5.0	mA dc
Gate to emitter voltage (threshold)	3403	$V_{CE} \geq V_{GE}$ $I_C = 0.25$ mA	$V_{GE(th)}$	2.0		V dc

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection /	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 3</u> - Continued						
State collector to emitter on-state voltage	3405	$V_{GE} = 15 \text{ V}; I_C = I_{C2}$ pulsed (see 4.5.1)	$V_{CE(ON)3}$		2.85	V
Forward voltage	4011	$V_G = 0; I_C = I_{C2}$	V_F		1.5	V
Low temperature operation:						
Gate to emitter voltage (threshold)	3403	$V_{CE} \geq V_{GE}; I_C = 0.25 \text{ mA}$	$V_{GE(th)}$		6.5	V dc
<u>Subgroup 4</u>						
Switching time test	3477	$I_C = \text{rated } I_{C2}; V_{GE} = 15 \text{ V dc}$ $V_{CC} = 0.8 \times V_{BR(CES)}; R_G = 2.0\Omega$				
Turn-on delay time			$t_{d(ON)}$		50	ns
Rise time			t_r		75	ns
Turn-off delay time			$t_{d(OFF)}$		300	ns
Fall time			t_f		210	ns
Total switching losses	3477	$I_C = \text{rated } I_{C2}; V_{GE} = 15 \text{ V dc}$ $V_{CC} = 0.8 \times V_{BR(CES)}; R_G = 2.0\Omega$	E_{total}		2.8	mJ
Reverse recovery time	3473	$di/dt \leq 200 \text{ A}/\mu\text{s}; I_F = I_{C2}$	t_{rr}		100	ns
Maximum reverse current			I_{RM}		10	A
<u>Subgroup 5</u>						
Not applicable						
<u>Subgroup 6</u>						
Not applicable						
<u>Subgroup 7</u>						
Gate charge	3471					
On-state gate charge			$Q_{g(ON)}$		140	nC
Gate to emitter charge			Q_{ge}		35	nC
Gate to collector charge			Q_{gc}		70	nC

1/ For sampling plan, see MIL-PRF-19500.

TABLE II. Group E inspections (all quality levels) for qualification only. 1/

Inspections	MIL-STD-750		Quality conformance inspection sample size
	Method	Conditions	
<u>Subgroup 1</u>			45 devices, c = 1
Thermal shock (temperature shock)	1051	-55°C to +150°C 500 cycles	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table V, steps 1, 2, 3, 4, 5, 6, and 7	
<u>Subgroup 2</u> 2/			45 devices, c = 1
Steady-state reverse bias	1042	Condition A, 1,000 hours $T_J = 150^\circ\text{C} + 0^\circ\text{C}, -15^\circ\text{C}$	
Electrical measurements		See table V, steps 1, 2, 3, 4, 5, 6, and 7	
Steady-state gate bias	1042	Condition B, 1,000 hours $T_A = +150^\circ\text{C}$	
Electrical measurements		See table V, steps 1, 2, 3, 4, 5, 6, and 7	
<u>Subgroup 3</u>			
DPA	2102		
<u>Subgroup 4</u>			5 devices, c = 0
Thermal resistance	3103 3101	See 4.5.2	
<u>Subgroup 5</u>			5 devices, c = 0
Barometer pressure test	1001	Condition C, $V_{CE} = 600\text{ V maximum},$ $I_{(ISO)} = 0.25\text{ mA}$	

1/ In initial design verification only (1 time testing).

2/ A separate sample shall be pulled for each test.

TABLE III. Groups A, B, C, and E electrical end-point measurements. 1/ 2/ 3/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Breakdown voltage, collector to emitter	3407	$V_{GE} = 0$; $I_C = 1.0$ mA bias condition C	$V_{BR(CES)}$	600		V dc
2.	Gate to emitter voltage (threshold)	3403	$V_{CE} \geq V_{GE}$ $I_C = 0.25$ mA	$V_{GE(th)1}$	3.0	5.5	V dc
3.	Gate current	3411	$V_{GE} = 20$ V; $V_{CE} = 0$ bias condition C	I_{GES}		100	nA dc
	Gate current	3411	$V_{GE} = 20$ V; $V_{CE} = 0$ bias condition C	I_{GES}		-100	nA dc
4.	Collector current	3413	$V_{GE} = 0$ bias condition C $V_{CE} = 80$ percent of rated V_{CE}	I_{CES}		250	μ A
5.	Static collector to emitter on-state voltage	3413	$V_{GE} = 15$ V Condition A, pulsed (see 4.5.1) $I_C = I_{C1}$	$V_{CE(on)1}$		3.0	V
6.	Static collector to emitter on-state voltage	3405	$V_{GE} = 15$ V condition A, pulsed (see 4.5.1), $I_C = I_{C1}$	$V_{CE(on)2}$		3.25	V
7.	Forward voltage drop	4011	$V_G = 0$; $I_F = I_{C2}$	V_F		1.7	V
8.	Thermal response	3103 3101	See 4.5.4				

1/ The electrical measurements for appendix E, table VII of MIL-PRF-19500 are as follows:

- Subgroups 3 and 4, see table III herein, steps 1, 2, 3, 4, 5, 6, 7, and 8.
- Subgroups 5 and 6, see table III herein, steps 1, 2, 3, 4, 5, 6, and 7.

2/ The electrical measurements for appendix E, table VIb (JANTX and JANTXV) of MIL-PRF-19500 are as follows:

Subgroups 2 and 3, see table III herein, steps 1, 2, 3, 4, 5, 6, 7, and 8.

3/ The electrical measurements for appendix E, table VII of MIL-PRF-19500 are as follows:

- Subgroups 2 and 3, see table III herein, steps 1, 2, 3, 4, 5, 6, and 7.
- Subgroup 6, see table III herein, steps 1, 2, 3, 4, 5, 6, 7, and 8.

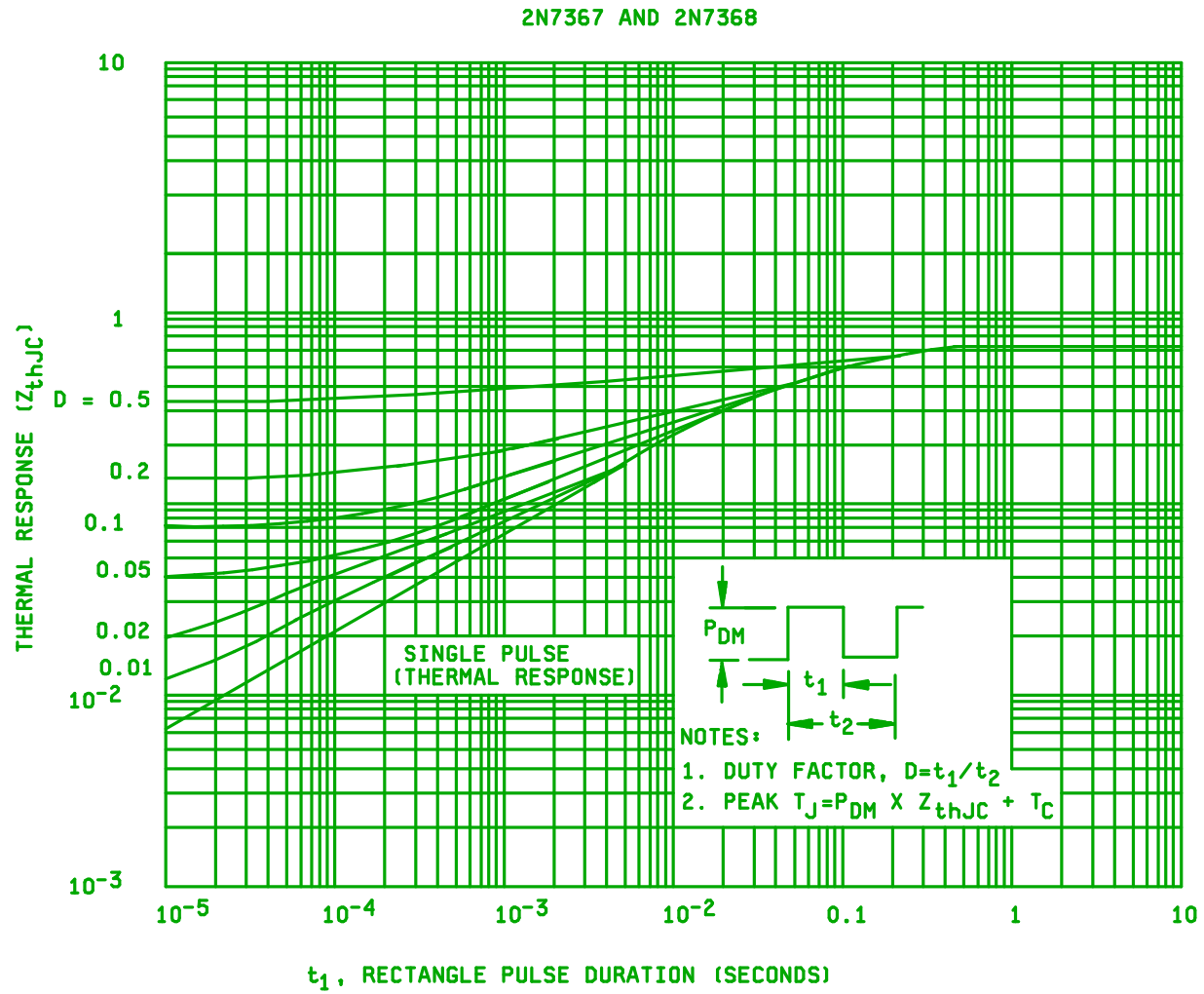


FIGURE 3. Thermal response curves.

5. PACKAGING

5.1 Packaging. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device. When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

5.2 Marking. Unless otherwise specified (see 6.2), marking shall be in accordance with MIL-PRF-19500.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Notes. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. See MIL-PRF-19500.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No.19500 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, ATTN: DSCC-VQE, 3990 East Broad Street, Columbus, OH 43216-5000.

6.4 Substitution information. Devices covered by this specification are substitutable for the manufacturers' and users' Part or Identifying Number (PIN). This information in no way implies that manufacturers' PIN's are suitable as a substitute for the military PIN.
Supersession and cross-reference data

Military PIN	Manufacturer's CAGE code	Manufacturer's and user's PIN
2N7367	59993	IRGMIC50U
2N7368	59993	IRGMVC50U

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:
Army - CR
Navy - EC
Air Force - 17
NASA - NA

Preparing activity:
DLA - CC

(Project 5961-1978)

Review activities:
Navy - TD
Air Force - 19, 70, 80, 85, 99

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL**INSTRUCTIONS**

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-PRF-19500/589A

2. DOCUMENT DATE (YYMMDD)
980415

3. DOCUMENT TITLE

SEMICONDUCTOR DEVICE, INSULATED GATE, BIPOLAR TRANSISTOR, N-CHANNEL, SILICON TYPES 2N7367 AND 2N3768, JAN, JANTX, JANTXV, AND JANS

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)**5. REASON FOR RECOMMENDATION****6. SUBMITTER**

a. NAME (Last, First, Middle initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)
Commercial
DSN
FAX
EMAIL

7. DATE SUBMITTED
(YYMMDD)

8. PREPARING ACTIVITY

a. Point of contact: Alan Barone

b. TELEPHONE
Commercial DSN FAX EMAIL
614-692-0510 850-0510 614-692-6939 alan_barone@dscclia.mil

c. ADDRESS:
Defense Supply Center Columbus, ATTN:
DSCC-VAT, 3990 East Broad Street, Columbus,
OH 43216-5000

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:
Defense Quality and Standardization Office
5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466
Telephone (703) 756-2340 DSN 289-2340